The Breast 46 (2019) 126–135

Contents lists available at ScienceDirect

The Breast

journal homepage: www.elsevier.com/brst

Original article

Physical activity in long-term breast cancer survivors – A mixed-methods approach

Ragna Stalsberg [a, *], Terje Andreas Eikemo [b], Steinar Lundgren [c, d], Randi Johansen Reidunsdatter [e]

[a] Department of Circulation and Medical Imaging, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology (NTNU), Post Box 8905 NO-7491, Trondheim, Norway
[b] Department of Sociology and Political Science. Faculty of Social and Educational Sciences, Norwegian University of Science and Technology (NTNU), NO-7491, Trondheim, Norway
[c] Department of Clinical and Molecular Medicine, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology (NTNU), Post Box 8905, NO-7491, Trondheim, Norway
[d] Department of Oncology, St. Olav's Hospital, Trondheim University Hospital, St. Olavs Hospital HF, Post Box 3250 Torgarden, NO-7006, Trondheim, Norway
[e] Department of Circulation and Medical Imaging, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology (NTNU), Post Box 8905, NO-7491, Trondheim, Norway

ARTICLE INFO

Article history:
Received 29 December 2018
Received in revised form
6 May 2019
Accepted 22 May 2019
Available online 26 May 2019

Keywords:
Questionnaire
Activity-log
Interview
Survivorship
Daily-life
Triangulation
Social inequality

ABSTRACT

Objectives: Traditional methods measuring physical activity (PA) may misrepresent breast cancer survivors (BCSs) and low-socioeconomic status (SES) groups. This study identifies PA-levels, routines and experiences among BCSs, in general and by SES, and explores whether a mixed-methods approach might unveil diversities of PA in BCS across SES.

Materials and methods: 250 BCSs referred to postoperative radiation therapy in 2007–2008 participated in a longitudinal follow-up study examining health-related quality-of-life and late-effects. Subsample-data on SES and PA were collected by questionnaires (n = 52), activity-logs (n = 52) and interviews (n = 37). Parallel mixed analyses were conducted, in combination with sequential, full-sample analyses of questionnaires and contrasting case analyses of logs and interviews.

Results: Dependent on which measurement used, 23%, 35%, 54% and 63% of BCSs met PA guidelines. Questionnaire-data revealed no significant differences in PA levels between SES groups. Log-data showed more PA bouts in high-SES BCSs, but no difference in min/week across SES. Neighbourhood walking was preferred, while scheduled exercise was rare. Interview-data added that PA was medicating, normatively described and accompanied by unfulfilled ambitions, particularly in low-SES BCSs. Balancing duties and activities was demanding. PA constraints were similar across groups. Domestic PA was important in low-SES, while high-SES BCSs described more energy.

Conclusion: Although PA levels among BCSs were similar across SES and equal to PA in the general population, SES differences became evident when measured by activity-logs and as stated in interviews. Future follow-up programs for BCSs could benefit from expanding the PA perspectives, thus better meet the needs of different SES groups.

Introduction

Breast cancer (BC) is detected in 1.7 million women globally every year [1] and is consequently the most common cancer in women. Estimates of BC survival rates in high-income countries range from 72% to nearly 100%, depending on BC stage at diagnosis [2]. Due to increasingly improved treatment methods aimed primarily at cancer elimination, BC survivors (BCSs) constitute a steadily growing group of persons who are living with residual

Abbreviations: PA, Physical activity; LTPA, Leisure time physical activity; OPA, Occupational physical activity; HPA, Housing physical activity; TPA, Transporting physical activity; SES, Socioeconomic status; HRQOL, Health related quality of life.

* Corresponding author.
E-mail addresses: ragna.stalsberg@ntnu.no (R. Stalsberg), terje.eikemo@ntnu.no (T.A. Eikemo), steinar.lundgren@ntnu.no (S. Lundgren), randi.j.reidunsdatter@ntnu.no (R.J. Reidunsdatter).

https://doi.org/10.1016/j.breast.2019.05.014

challenges that affect their health-related quality of life (HRQOL) [3]. In order to facilitate return to normal life and reduce recurrence, BCSs are advised to engage in regular physical activity (PA). Previous studies have reported positive effects of exercise on HRQOL, risk of recurrence and mortality among BCSs [4–6]. However, cancer survivors are faced with several compounding factors [3], which each individual seems to handle differently. Thus, follow-up programs should extend beyond biomedical dimensions in order to facilitate regular PA among the socially diverse groups of BCSs.

In general, BCSs experience barriers to and facilitators of PA much similar to those among the general population [7], as lack of knowledge or enjoyment from PA, poor body image or discouragement [8], and lack of time and company [7,9,10]. Cancer-specific restrictions include fatigue, neuropathy and joint pain [7,11]. The proportion of BCSs who engage in recommended amounts of PA, equals the percentage of healthy women meeting such recommendations [12–14]; however, evidence indicates that there are PA differences across socioeconomic status (SES) groups. Previous studies have reported that highly educated BCSs are more physically active than less educated BCSs [15,16], and that public recommendations are less likely to be met by BCSs residing in low-SES neighbourhoods [17] and BCSs without university degrees [18] compared to their high-SES counterparts.

It is unclear whether social inequalities in PA among BCSs translate into social inequalities in BC survival rates. For a considerable time, higher education has been related to higher BC incidence and mortality. As of today, BC incidence rates have levelled off and mortality has declined [19]. Conversely, BC mortality rates have increased in women <50 years of age with lower SES [19,20]. Clearly, higher-educated women seem to have benefited the most from improvements in incidence and mortality [19]. Patient delays [21] are assumed to be significant determinants of the association between SES and mortality rates, as women with low SES tend to delay in consulting a doctor [22] and use less endocrine therapy [23]. However, an unhealthy lifestyle, including physical inactivity, is suggested to be equally as important as belated medical examination [24]. If this should prove to be the case, a better and more thorough understanding of how PA manifests differently across SES groups could contribute to more socially targeted BC follow-up. It is, however, important to be aware of the complexity of PA and challenges entailing traditional methods when PA is investigated.

PA, defined as *"any bodily movement produced by skeletal muscles that results in energy expenditure"* [25, p.129], is difficult to measure without introducing biases related to its constituents: type, intensity, frequency or duration [26]. Self-reporting questionnaires have been the most commonly used method for collecting data on PA levels [27], and seem also to be frequent in epidemiological studies of BC populations [28]. However, such questionnaires often include response options that are unable to accommodate the mental and physical fluctuations caused by for example fatigue and pain, which often hinder BCSs from undertaking regular PA. As a result, PA levels in BCSs with irregular PA might be misrepresented. Furthermore, inaccurate interpretations of total PA levels frequently occur, as questionnaires often lack information on occupational PA (OPA), transporting PA (TPA) or housing PA (HPA). To this end, we could add that the assumed positive relationship between SES and PA in the general population would seem to be mainly an association between education and leisure-time PA (LTPA) [29–31]. Hence, using traditional quantitative methods alone when attempting to understand PA may be insufficient, and probably introduces a risk of misrepresenting both BCSs and low SES groups.

Inspired by Engel's critique of the biomedical approach to illness [32] and in line with contemporary health-behaviour models [33,34], it could be argued that a multi-perspective understanding of PA behaviour in long-term BC survivorship, including both qualitative and quantitative dimensions of PA, could direct greater attention to the specific challenges of all sub-groups of BCSs. Hence, knowing that lack of time, in combination with fatigue, is a pronounced challenge among BCSs [7,11], and that time scarcity may be related to social health inequalities [35], approaches depicting BCSs' time-use might allow important, but previously overlooked, aspects of these variables to surface. In addition, as barriers to PA among BCSs seem to vary across SES groups [36], BCSs' in-depth descriptions of their experiences with PA could further our understanding of the specific challenges of each sub-group of BCSs for engaging in PA.

The aim of the present study was therefore to a) identify levels of-, daily routines for- and experiences with PA among long-term BCSs, in general and on the part of SES groups, and b) explore whether a mixed method approach might unveil diversities of PA practice in BCS across SES groups.

Methods

A total of 250 BCE patients referred for postoperative irradiation at a Norwegian university hospital in 2007–2008 were enrolled in a longitudinal follow-up study concerning HRQOL and late effects. The recruitment procedures and baseline sample characteristics are described elsewhere [37]. Participants for the present sub-study were recruited at the main study's 7–8 -year follow-up check at the outpatient cancer clinic. All participants were invited to be interviewed or to write an activity-log, or both. At the time of invitation, 71 women from the baseline sample had completed a follow-up questionnaire for the main study. Thirty-seven of these women volunteered for interviews and 52 for activity-logs (Table 1).

Self-reported data on PA and socio-demography were extracted from the main study questionnaire, and filed in SPSS (v25).

Notebooks were handed out at follow-up controls, requesting records of time, place and company (and possibly comments) for each activity. All activities throughout a 24-h day were to be logged for ≥4 days (one had to be a Sunday). Logbook-data were transferred into Vardagen [38] and VISUAL-TimePAcTS [39].

Semi-structured in-depth interviews were conducted to explore the women's care pathway, daily activities, and HRQOL and health. The perceived meaning of PA, personal grounds for being physically active, and expectations regarding appropriate PA participation, were touched upon while talking about daily activities and health perceptions. The interviews were transcribed verbatim and filed in NVivo (QSR, v11).

Measures

In the *questionnaire*, PA was measured as frequency (<1 bout/week; 1 bout/week; 2–3 bouts/week; daily), intensity ('no sweat or heavy breath'; 'heavy breath and sweat'; 'push myself to exhaustion'), duration (≤15 min; 16–30 min; 31–60 min; >60 min), and type (walk/jog/run; ball playing; Nordic skiing; bicycling; swimming; studio; martial art; dance; other). SES was determined as level of education (Low:{primary and lower secondary; upper secondary; high school}; High: {college degree; university degree >3 years}), household income (NOK1000 ≈ €100): (Low:{<100; 100–299; 300–499}, High: {500–699; 700–899, ≥900}), and work status (employed; partly employed; home working; unemployed; partly on sick leave; on sick leave; rehabilitation; disability pension; retired; student).

In *activity-logs*, PA was measured as frequency (bouts counted), intensity ('no sweat or heavy breath' unless commented

Table 1
Participant characteristics in study samples. Frequencies (%).

	Logbook/ survey sample (n = 52)		Interview sample (n = 37)	
Age at follow-up:				
Mean [range][SD]	62 [31–87] [10.0]		61 [43–87] [9.8]	
Mode	67		60	
Marital status:				
Married or cohabited	42	(81)	24	(65)
Divorced	5	(9)	5	(14)
Single	2	(4)	5	(14)
Widowed	3	(6)	3	(8)
Socioeconomic status:				
Education:				
Primary and lower secondary (1–6, 7 or 9 years)	6	(12)	5	(14)
Upper secondary, basic (<12 years)	25	(48)	18	(4)
Upper secondary, final (12 or 13 years)	7	(13)	6	(15)
College degree (3 years)	4	(7)	4	(11)
University degree (>3 years)	8	(15)	4	(11)
Unknown	2	(4)	0	(0)
Household income (1NOK ≈ 0,1 Euro):				
100.000–299.999	7	(13)	9	(24)
300.000–499.999	12	(23)	9	(24)
500.000–699.999	13	(25)	7	(19)
700.000–899.999	11	(21)	6	(16)
>900.000	7	(13)	5	(14)
Unknown	1	(2)	1	(3)
Work status:				
Employed	14	(27)	11	(30)
Partly employed	8	(15)	4	(11)
Unemployed	1	(2)	1	(3)
Partly on sick leave	2	(4)	3	(8)
Sick leave	1	(2)	0	(0)
Disability pension	9	(17)	8	(22)
Retired	17	(33)	10	(27)
Types of BC treatment:				
Breast conserving surgery	30	(58)	20	(54)
Radical (mastectomy) surgery	22	(42)	17	(46)
Chemotherapy (adjuvant/neo-adjuvant)	32	(61)	25	(68)
Endocrine treatment	35	(67)	13	(35)
Trastuzumab	19	(36)	12	(32)

differently), duration (min. from activity start to activity end), and type (as logged). Additional measures were 'time of day in PA' (asleep–08:59; 09:00–14:59; 15:00–19:59; 20:00–sleep), 'PA company' (alone/not alone), 'PA places' (described), and 'daily-life activities before/after PA' (as logged).

The *interview* transcripts provided data on occupation and utterances about PA.

Data analyses

A parallel mixed analysis was conducted, although full sample analyses of questionnaires and contrasting case analyses of logs and interviews were run sequentially [40] to detect SES differences. The analyzing phases are presented in Table 2.

Ethical issues

All participants signed a new informed consent form. We will refer to the participants by fictitious initials in order to retain anonymity.

Results

Rates of PA type, -frequency, -intensity, -duration and activity categories, assessed from activity-logs and questionnaires, are given in Table 3[3] Questionnaire data showed that 83% ($n = 43$) of the BCS walk/jog/run, and that 38% ($n = 20$) cycle when exercising. By comparison, the most logged LTPA or TPA was walking (43 occasions). Gardening, which was not specified in the questionnaire, was logged on 12 occasions. There were small differences between questionnaire-reported and logged frequency of PA. The intensity, however, differed between questionnaire-data and log-data, as 38% ($n = 20$) of the BCSs reported that they exercised with 'no sweat or heavy breathing', whereas such intensity was logged by 96% ($n = 50$). Further, 53% ($n = 28$) BCSs usually exercised with 'heavy breathing and sweat' according to the questionnaires, while 21% ($n = 11$) had logged this level of intensity. Finally, the total duration of PA reported in the questionnaires ranged from 0 to 420 min/week, whereas for logs, the duration ranged from 0 to 1205 min.

Questionnaire data showed that 35% (n=18) were 'physically active' according to calculations based on questionnaire registered PA duration, as were 54% (n=28) when intensity was included in the calculations. The corresponding numbers for activity-logs were 63% ($n = 33$) and 23% ($n = 12$). A total of 337 days was logged as activities for 5 days ($n = 8$), 6 days ($n = 4$), and ≥one week ($n = 40$).

Additional daily-routine data from the activity-logs showed that the total number of times/week the BCSs engaged in TPA or LTPA ranged from 0 to 21. The preferred location for LTPA was neighbourhood surroundings including gardens and areas close to the cabin. Being in the woods, the hills or by the seaside was the second choice. Swimming pools, gyms and dancing venues were occasionally registered. TPA involved primarily transport to paid work, and less often to other locations. All TPA was registered without partner(s), but 55% of LTPA (including gardening) bouts were performed together with a partner. Most of the PA took place between 9 a.m. and 3 p.m., although early-morning or evening bouts were common.

The interview analyses ($n = 37$) confirmed that walking was the preferred PA, albeit stories about alternative activities were told. Six additional themes emerged from the analyses: 'positive associations to PA', 'fulfilling ambitions or not', 'PA constraints', 'the art of balancing duties and leisure time activities', 'to appear physically active', and 'strategies for PA'. Fig. 1 provides a depiction of these themes, followed by representative quotes.

SES-related differences in PA

Results from SES-related analyses are presented in Table 4 and Fig. 2. PA duration assessed by *questionnaire* ($n = 50$) did not differ significantly between high- and low-income groups (not shown), or between high- and low education groups. PA frequency was equal across dichotomised educational levels. However, the intensity was higher in BCSs with higher education than in BCSs with lower education. Walk/jog/run was the most reported PA type in both groups, but a higher percentage was seen in the higher-education group. Parallel *activity-log* analyses (n=8 + 9) showed a significantly higher number of LTPA or TPA bouts among high-SES BCSs ($p = .002$) (see also Fig. 2). However, there was no significant difference in the number of min/week in LTPA or TPA between the groups ($p = .15$).

Further, neighbourhood surroundings were the most preferred location for PA in both SES-groups, although TPA was equally prevalent in high-SES BCSs. Fig. 2 depicts activity-logs as diagrams (low-SES logs in top row). The 7-coloured lines at the bottoms of the left cell represent a 7-day week. Vertically, each participant's

[3] Due to too sparse descriptions of HPA, although logged in 175 days, the table includes LTPA and TPA exclusively.

Table 2
Phases of analysis.

General analyses
First, to avoid an untimely identification of SES differences in PA leading to a debilitated qualitative analysis, *interviews* ($n = 37$) were probed, and any texts dealing with PA were extracted. Each excerpt (5-17 pages) was inductively analysed thematically. Two researchers agreed on the initial and ensuing grouping of family codes, aiming at an uncomplicated number of thematic categories.[1] Codes, family codes and themes, upon which there was no agreement, were discussed and redefined. On this basis, one researcher coded the remaining transcripts
Descriptive analyses of frequency, intensity, duration as well as type of PA from *questionnaire* data ($n = 52$) were run. 'Activity level' was based on a) duration of LTPA and TPA (PA ≥150 min = 'active'. PA <150 min = 'not active') and b) intensity *and* duration of LTPA and TPA (PA ≥60 min with 'heavy breath & sweat' = 'active'. PA <60 min and/or lower intensity = 'not active')
TPA, any physical exercise, hiking or walking and other physically demanding activities from other DLAs in the *activity-logs* were extracted. Descriptive analyses of frequency, intensity, duration and type of PA, as well as time of day, types of DLAs connected to PA, venues for PA and PA-company, were run
'Activity level' from *log-data* were calculated, as done for questionnaire data
Questionnaire data and *log-book* data were compared in terms of PA duration, -intensity, -frequency, -type and 'activity level'
Results from interview analyses were brought in, in order to supplement the results from questionnaire and log-book analyses
SES-analyses
Mann-Whitney U tests were run for differences between high- and low-income group and between high- and low-educational group regarding *min/day in PA, frequency* and *intensity,* assessed by *questionnaires* (*n=50)*
Based on a combined rank of (highest and lowest) educational level, income and occupation, two SES sub-samples ('high SES' ($n = 8$) and 'low SES' ($n = 9$)) were selected for comparison of potential SES differences in *interview data* and *log-data:*
Two researchers coded the SES-determined sets of *interview* transcripts independently and unaware of SES- membership. The same procedure as in the full sample analysis was followed. Related themes, which emerged from each set, were discussed, and redefined into joint themes[2]
Descriptive comparisons of 'types and places of PA', 'DLA before/after PA', 'time of day in PA' and 'PA company', assessed in activity-logs, were conducted
Mann-Whitney U tests for differences in PA bouts/week and min/day assessed in activity-logs between the SES subsample groups were run.

[1] Example: we linked family codes such as 'impossible to both exercise and work' (based on inter alia 'work has taken over' and 'lack of physical surpluses') and 'self-regulated amount of exercise' (based on inter alia 'balance exercise and rest' and 'exercise when I feel ready') to the theme 'the art of balancing duties and leisure time activities'.

[2] Example: 'active outdoors', 'the cabin' and 'transport' were common family codes grouped into the descriptive theme 'how BCSs are physically active', but the codes contained different information dependent of SES group. For instance, within the family code 'transport', low-SES BCSs spoke mostly about car transport, while high-SES BCSs more often spoke about walking or cycling. Likewise, in the family code 'active outdoors', high-SES BCSs related strenuous hiking *in addition* to the short walks that were common also among low-SES BCS.

Table 3
LTPA and TPA measured by questionnaires and activity-logs completed by 52 BCSs. Frequencies (%).

	Questionnaires			Activity-logs		
Type[a,b]	Walking, jogging, running	43	(83)	Walking/hiking	43	
	Bicycling	20	(38)	Gardening	12	
	Studio	12	(23)	Bicycling	7	
	Skiing	11	(21)	Studio/exercising	11	
	Swimming	7	(12)	Swimming	4	
				Dance	1	
Frequency	Every day	12	(23)	Every day	12	(23)
	2–3 days/week	24	(46)	2–3 days/week	29	(56)
	= once a week	11	(21)	= once a week	9	(17)
	< once a week	5	(9)	< once a week	2	(4)
Intensity[c]	No sweat or heavy breath	20	(38)	No sweat or heavy breath	50	(96)
	Heavy breath and sweat	28	(53)	Heavy breath and sweat	11	(21)
	Push myself to exhaustion	1	(2)	Push myself to exhaustion	8	(15)
	Not assessed	3	(6)	No activity	2	(4)
Duration	Total (average) minutes	0–420		Total minutes	0–1205	
Active	Active; 150 or more min/week[d]	18	(35)	Active; 150 or more min/week	33	(63)
	Active, intensity included	28	(54)	Active, intensity included	12	(23)

[a] The question allowed for more than one answer, hence the total number of replies exceeds 52.

[b] Log data refer to the number of times an activity was logged, which renders percentages impossible.

[c] Questionnaire data refer to the numbers of BCSs who answered the given average intensity during a normal week. The log data refer to numbers of BCSs who in fact had logged PA in said intensity during the week in which they logged activities.

[d] Calculations based on response options means, e.g. 2–3 bouts/week in 31–60 min = 2,5 × 45min = 113 min.

24-h days are represented by bars, of which all time spent within different PA domains is coloured. Nine exercise sessions (green bricks in the left bottom diagram) were logged by BSCs in the high-SES group as were 2 by BCSs in the low-SES group (left top diagram). The diagrams in the centre column show the sum of activities per PA-domain logged at different hours throughout the week (including exercise, gardening, other LTPA and TPA). There were hardly any visible differences between the SES-groups in the time of day spent in PA. To the right, logged HPA is added, showing the contribution of HPA to total PA. On average, HPA occupied 6.6 h/week in low-SES BCSs, and 5.7 h/week in high-SES BCSs (numbers not shown).

Subsample *interview* analyses added that although the two SES groups experienced similar challenges relevant for PA, they differed in *'how, and with whom they are active'*, their *'energy levels'*, and their *'approach to PA'* (presented condensed in bottom rows of Table 4):

Both groups engaged in walking, but there was a propensity for short walks among low-SES BCSs. Sustained activities, such as mountain hiking, hours of marching (band) rehearsals, or extensive gardening were reported among high-SES BCSs. Moreover, whereas low-SES BCSs reported both active and inactive transport, high-SES BCSs reported little motoring. Furthermore, spending time and energy on family and housekeeping seemed important to low-SES BCSs.

The need for rest was expressed by almost every BCS. High-SES

Fig. 1. Themes revealed from interview analyses of all interviews, followed by representative quotes.

BCSs tended to feel fit after a nap, whereas no such tendency was found in the low-SES group. Instead, the importance of being busy (and not appearing lazy) was noticed among low-SES BCSs. High-SES BCSs reflected high energy levels by being engaged in physically demanding activities, and by aspiring to even further engagement. The importance of balancing activities and duties was also more explicit in high-SES BCSs. Lastly, although the majority reported being in good health, the low-SES BCSs emphasised clearly how years of working had worn them out.

The trend that PA was associated with bad conscience emerged as evident primarily in low-SES BCSs. Analyses of interviews of high-SES BCSs revealed a deliberate choice to be engaged in PA after BC. The will to make every effort to accomplish planned exercise was, in the same way, noticeable in high-SES BCSs. An energetic

Table 4
PA among BCS with high and low SES based on data retrieved from questionnaires, logbooks and interviews.

	High education (n=20) (%)			*Low education (n=30) (%)*		
Mean age	55			67		
Household income >500.000 NOK	17		(85)	14		(47)
PA in TOTAL SAMPLE OF QUESTIONNAIRE (n = 50)						
PA ≥150 min.	9		(45)	8		(27)
Active[a]	13		(65)	14		(47)
≥2–3 times/week	14		(70)	21		(70)
≤1 time/week	6		(30)	9		(30)
Light	4		(20)	14		(47)
Get sweaty	12		(60)	16		(53)
Exhausted	1		(5)	0		–
No answer	3		(15)	0		–
Walk/jog/running	14		(70)	27		(54)
Skiing	6		(30)	5		(6)
Bicycling	7		(35)	13		(43)
Swimming	3		(15)	4		(13)
Studio	8		(40)	13		(43)
Combat sports	0		–	1		(3)
Dancing	0		–	1		(3)
Other	6		(30)	6		(20)
***PA in* SUBSAMPLE of LOGS:**	***Highest SES (n=8) (%)***			***Lowest SES (n=9) (%)***		
Average min/day	76			46		
Average bouts/week[b]	13			5		
Walking the dog	33			9		
Gardening	9			3		
Short/long walks	10			22		
Exercise	7			0		
Dance	0			1		
Swim	2			0		
TPA	43			15		
Places in PA (104 reported)	Neighbourhood surroundings	43	(41)	Neighbourhood surroundings	30	(59)
	The woods/hills/seaside	13	(13)	The woods/hills/seaside	7	(14)
	Gym (incl. sports hall or pool)	5	(5)	Gym (incl. sports hall/pool)	0	–
	Dancing venue:	0	–	Dancing venue	1	(2)
	Between places:	43	(41)	Between places	15	(29)
DLAs before and after PA (typical)	Before: Food(related), rest, morning toilet, social, night sleep, work, doc's, organization			Before: Food(related), rest		
	After: TV, rest, work, social, night toilet, night sleep, doctor's visit, organization			After: TV, rest, work		
Time of day in PA	00:00–08:59: 24%	15:00–19:59: 37.5%		00:00–08:59: 21.5%	15:00–19:59: 24%	
	09:00–14:59: 28%	20:00–23:59: 9.5%		09:00–14:59: 45%	20:00–23:59: 10%	
PA company	Without company in 33–87% of all bouts			Without company in 0–100% of all bouts		
***PA in* SUBSAMPLE of INTERVIEWS**	***Highest SES (n = 8)***			***Lowest SES (n = 9)***		
How BCSs are physically active, and company	Walks (both long lasting and short), low motoring levels, frequently visiting holiday house for recreational activities. Various company, but the joint project is important			Short walks, inactive commuting between places, hardly ever-visiting holiday house. Various company.		
Energy levels and fitness	Lower than before diagnosis. Engaged in demanding activities beside PA. Desire to further engagement and the tediousness of doing 'nothing'. The art of balancing rest and total PA.			Lower than before diagnosis. Importance of (appearing) being occupied by housework. Lower energy level could be explained by being older.		
Approach to PA	PA is good, and I certainly want to do it no matter the pain and my limitations			PA is good, and I try my best or should have done more		

[a] PA for at least 60 min/week, producing 'heavy breath or sweat'.
[b] Significant difference between groups.

attitude was reflected also in the ability to ignore the pain that could arise from some types of PA, and to follow partners' exercise regimes.

Discussion

The aim of the present study was to a) identify levels of-, daily routines for- and experiences with PA among long-term BCSs, in general and by SES, and b) explore whether using complex mixed methods analyses of data from one sample might expand current knowledge of PA practice in BCS. We found that 23–63% were categorized as physically active, depending on the method for calculating PA level, and that walking was the preferred type of PA. The most common daily PA routines were individual outdoors activities in the BCSs' home or cabin surroundings, and TPA, mainly to work. PA was described as a positive experience, yet infrequent, however difficult to balance against duties and pronounced needs for rest. SES differences, which became evident when activity-logs and interviews were analysed, were mainly about higher intensity and more LTPA in high-SES BCSs, as opposed to obligations to HPA

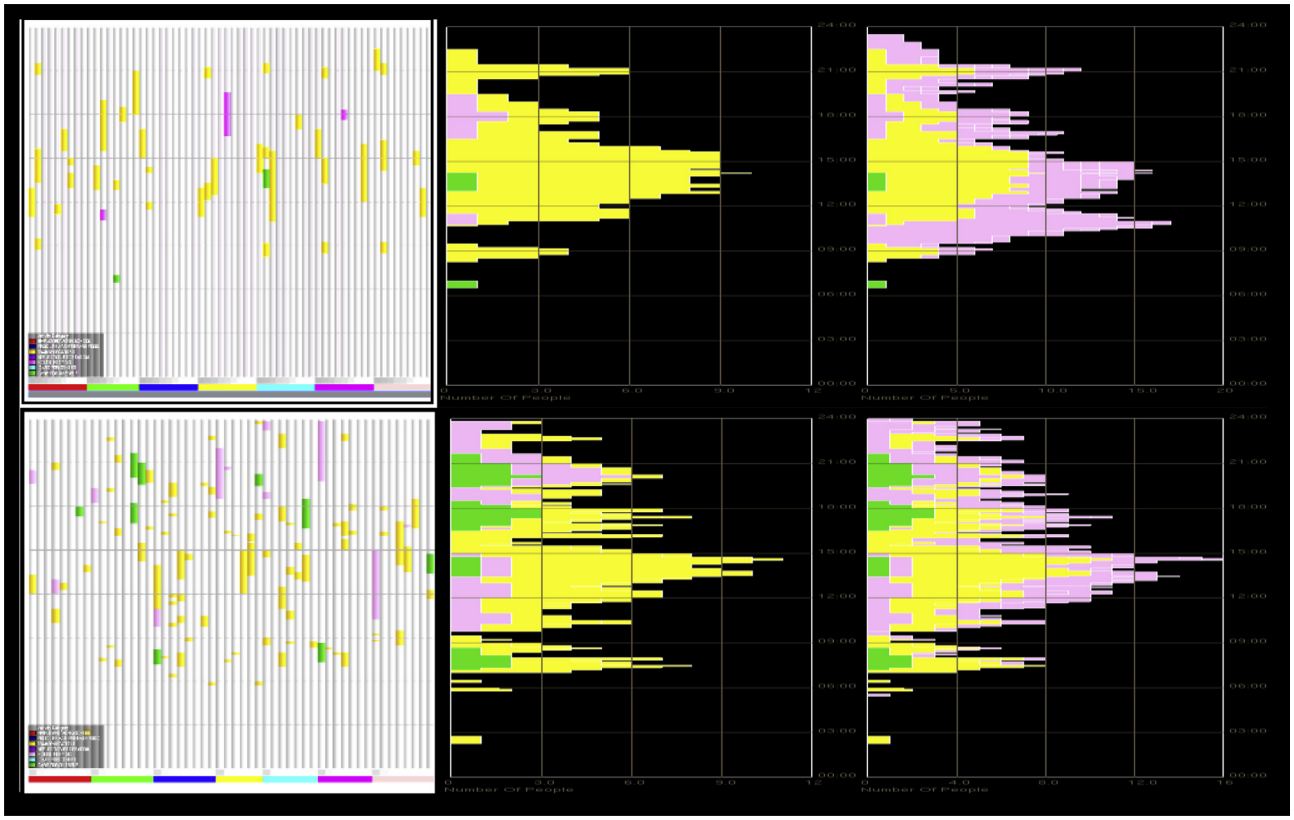

Fig. 2. Activity-log depictions [39] of daily time-use within domains of PA in BCSs with high (bottom row) and low (top row) SES. Left column: coloured lines symbolise a 7-day week. Vertical bars represent each participant's 24-h days. Time spent within different PA domains is marked with colours (exercise PA = green, gardening PA = pink, other LTPA and TPA = yellow). Center column: the sum of registrations within exercise PA, other LTPA and TPA, and gardening PA, logged at different hours a day during the week. Right column: HPA is added (extended pink areas).

and valuations of not appearing lazy, among low-SES BCSs. Across the three different data sets, results confirmed and complemented, but were as well contradictory.

The quantitatively measured PA-levels showed that BCSs seem to equal (or even surpass) women in the general population in terms of meeting national guidelines of 150 min/week of moderate PA, as 35% of Norwegian females met such guidelines in 2014 [41]. First, this finding corresponds with results from Irwin et al. [12], where the PA-levels of BCSs' were equal to PA-levels in general. Although previous studies [12–14], as well as the present one, demonstrate that the majority of BCSs are less physically active than what is recommended, they show that BCSs as a group do not perform less well than other women. Previous habitual PA practice as well as participation in rehabilitation programmes that include PA education for BCSs may account for their rather high PA levels. Taken together with the possibility that physically inactive BC patients were ineligible to participate in our study due to illness, or they were dead, the sample's average PA-level may be somewhat higher than what is fully representative for the BCS population. On the other hand, questionnaires have previously been reported to allow for over-reporting PA levels [42], also among women diagnosed with BC [43]. The fact that the relationship between duration and intensity of PA appeared inverse for log-data compared with questionnaire-data in the present study, probably illustrates such phenomenon. Although the intensity of PA reported in activity-logs might have been underestimated, the interviews, which were made with the same individuals, confirm that most PA among BCSs was at a rather low intensity. Regardless, the reality of PA among BCSs is likely much more nuanced than we can read from traditional quantitative data.

Low education is often cited as an important determinant of poor health [44], implying that, insufficient PA-levels may be understood in light of poor health literacy [45]. Although many BCSs in our study were insufficiently active, almost none identified themselves as non-active according to the interview-data, as they talked a lot about how being physically active positively affected their experienced late-effects after BC treatment. Additionally, their references to previous PA-levels and their wish to appear busy, together with reflections upon their perceived PA-level, indicate sufficient knowledge about the impact of PA. Instead, explanations may lie in the combination of late effects shared by cancer survivors [7,11] and general barriers to PA [7–9]. Although such constraints could reflect excuses as much as true barriers to PA [46], something that is not exclusive to the BCS population, their negative effect on BCSs' ability to comply with appropriate health advice may increase as they interact. At least in the case of BCSs in the present study, extra health education regarding PA seems redundant.

Conceptual confusions regarding PA are common, and it should be noted that our statistics were based exclusively on two domains of PA, TPA and LTPA. Thus, the findings are less valid in terms of the definition offered by Caspersen et al. [25] as mentioned earlier. Insufficient data on HPA and OPA may have led to misconceptions about real PA levels in BCSs who are inactive during leisure time, but may have physically demanding occupations or domestic obligations. Similar misconceptions have received attention in previous reviews [29–31] and have also been recognised in studies of BCSs [12,36]. Further support for such claims can be found in a study of PA in older retired men, which demonstrated that daily

activities could account for at least as many Metabolic Equivalent for Tasks (METs) per week as is recommended [47]. Thus, complementing questionnaire PA data with activity-logs reveals significant information. A majority of the BCSs in the present study were no longer working, thus they would not report any current OPA; however, HPA was logged every other day. Therefore, even more BCSs might have been categorised as 'physically active' had all PA-domains been included in the analyses. Again, the qualitative data, retrieved from the same sample as were log- and questionnaire-data, support such a hypothesis, as many daily physical activities were described among the total activities that the participants employed in their daily life. Hence, for some BCSs, their perceived level of total PA might better reflect the true level of total PA than does the level derived from the quantitative analyses.

Pre-set response options in PA questionnaires, often designed for the normal population, are unable to accommodate possible fluctuations that hold BCSs back from regular PA. For the majority of BCSs in our study, weekly PA routines were mostly related to outdoor walking, and much less frequently to regularly time-set exercise, which is consistent with previous studies [36,48]. Besides confirming the preference for walking, our supplementary data from activity-logs and interviews demonstrate how neighbourhood walking, at hours that suit the BCS, makes it easier to deal with exhaustion or fatigue. The opportunity for easy access, as well as easy return home, together with feelings of immediate and tangible health effects, seem to render such PA largely effortless. Although recognisable, these findings might counter a common misunderstanding, also reflected in several of the interviews, that scheduled, strenuous exercise is crucial for leading a physically active life. The health effects of daily PA, such as walking, are evident [49], and several studies support the hypothesis that sedentary behaviour is as significant for health as is LTPA duration [50]. Furthermore, as is evident from our log and interview data, the mental and physical fluctuations experienced by many BCSs affect their PA practice to a considerable degree. Balancing duties and leisure time activities in a way that makes both of them manageable was associated with an extended time-use compared with time use prior to diagnosis. A preference for not scheduling PA, or having days off from paid work, relates to the freedom to work as well as engaging in leisure activities *and* rest when necessary. Overall, the present results reveal the need for flexibility in everyday life and demonstrate how quantitative questionnaire reports of an 'average week of PA' might result in misinterpretations of PA levels in BCSs.

It is unclear whether the level of PA contributes to social inequality in BC survival and HRQOL in later life. In such cases, there are reasons to suggest that knowledge about domain specific PA is important, and not only that of the overall level of PA. In our material, no significant associations were found between SES and 'active' categories, whether based on both duration and intensity of PA, or exclusively on duration. These results are inconsistent with previous studies accounting for both the intensity and duration of PA, which have reported that BCSs who have completed higher education are more physically active than BCSs with lower education [15–18]. Our results may of course, be explained by the small sample size. However, as a reminder of the significance of considering all PA domains, the activity-log figures, which show a higher proportion of HPA in low-SES BCSs compared to high-SES BCSs, indicate the relative significance of HPA for total PA. Also, further elaborated in the interviews, the low-SES BCSs, in clear contrast to the high-SES BCSs, stressed that domestic work was highly appreciated, and that such activities reflected their level of busyness. On the other hand, high-SES BCSs focused on leisure-time activities as being undertaken for their own well-being. Obviously, differences in age and employment status could explain such patterns in LTPA, TPA and HPA, as the high-SES BCSs were on average ten years younger and working, thus having less time for housework and gardening, and were expected to be more physically fit for strenuous activities. However, previous studies support the possibility that such results could relate to SES. For example, Owusu et al.'s results indicate that family background could influence decisions regarding PA among BCSs [36], and Ball et al. indicated the notion that preferences for different types of PA in women are dependent on SES [51]. From our own data, we could add that although a majority of the low-SES participants were retired and thus not engaging in OPA, many of the women felt worn out from heavy workloads in their previous working life. There are reasons to believe that such weariness is likely to affect their current level of LTPA. In any case, the fact that we detected SES differences after analysing complementary data, should remind us of the risk of misinterpreting data when using one method (albeit well established) regardless of the context.

Previous results of SES differences in PA among BCSs are consistent with social health inequalities in general [52]. However, research samples will rarely be sufficiently representative across SES groups as long as high-SES individuals volunteer for participation more frequently than low-SES individuals [53,54]. The Declaration of Helsinki clearly prevents researchers from obliging vulnerable groups to participate in studies with the aim of obtaining representative samples, unless it is of the outmost importance [55]. The most vulnerable BCSs, i.e. those with severe late effects and lowest SES, are therefore least likely to participate in studies such as ours. Although our combination of methods aims to provide previously overlooked information for the benefit of low-SES BCSs, the real SES differences might be even greater than we have been able to identify. Finally, our results should be interpreted in light of the Norwegian context. More specifically, the transferability of our results to other countries and regions may be limited by the fact the proportion of higher educated is larger in Norway than elsewhere. This can be illustrated by the fact that in populations with larger proportions of high educated and smaller proportions of low educated, the excess mortality among intermediate and low educated is larger, all other things being equal [56].

Conclusion

The levels of PA in long-term BCSs were not different from PA levels previously reported for the general population. Neither were there any significant differences in PA levels between BCS SES groups. However, SES differences in PA were evident in terms of their routines for- and experiences with PA as measured by activity-logs as well as what was stated in interviews. Thus, important additional information about BCSs' PA was uncovered by including the latter two data sets in the mix. Combinations of qualitative and quantitative methods, including an increased use of activity-logs at the expense of traditional questionnaires, may therefore be recommended in future studies to get a more accurate and balanced picture of PA among BCS. In addition, follow-up programmes for BCSs could benefit from expanding the PA perspective to include more dimensions of PA, and thus better meet the needs of different SES groups.

Ethical standards

The study was conducted in accordance with the Declaration of Helsinki and was approved by The Regional Committee for Medical and Health Research Ethics (REC Central 2009/108.4.2006.2856). All participants signed a new informed consent form before undertaking any procedure related to the present study.

Declarations of interest

None.

Acknowledgements

The data analyses and writing the present article was supported by The Norwegian Extra Foundation for Health and Rehabilitation.

References

[1] Ginsburg O, Bray F, Coleman MP, et al. The global burden of women's cancers: a grand challenge in global health. The Lancet 2017;389(10071):847–60. https://doi.org/10.1016/S0140-6736(16)31392-7.
[2] Noone A, Howlader N, Krapcho M, et al. SEER cancer statistics review, 1975-2015. Bethesda, MD: National Cancer Institute; 2018.
[3] Hewitt M, Greenfield S, Stovall E. From cancer patient to cancer survivor: lost in transition. Committee on cancer survivorship: improving care and quality of life, institute of medicine and national research council. Washington, DC: The National Academies Press; 2006.
[4] Vijayvergia N, Denlinger CS. Lifestyle factors in cancer survivorship: where we are and where we are headed. J Personalized Med 2015 Jul 2;5(3):243–63. https://doi.org/10.3390/jpm5030243.
[5] Carmichael AR, Daley AJ, Rea DW, et al. Physical activity and breast cancer outcome: a brief review of evidence, current practice and future direction. Eur J Surg Oncol 2010 Dec;36(12):1139–48. Epub 2010 Oct 13, https://doi.org/10.1016/j.ejso.2010.09.011.
[6] Li T, Wei S, Shi Y, et al. The dose-response effect of physical activity on cancer mortality: findings from 71 prospective cohort studies. Br J Sports Med 2016 Mar;50(6):339–45. Epub 2015 Sep. 18, https://doi.org/10.1136/bjsports-2015-094927.
[7] Sander AP, Wilson J, Izzo N, et al. Factors that affect decisions about physical activity and exercise in survivors of breast cancer: a qualitative study. Phys Ther 2012;92:525–36. https://doi.org/10.2522/ptj.20110115.
[8] Spector D, Battaglini C, Groff D. Perceived exercise barriers and facilitators among ethnically diverse breast cancer survivors. Oncol Nurs Forum 2013 Sep;40(5):472–80. https://doi.org/10.1188/13.ONF.472-480.
[9] Brunet J, Taran S, Burke S, et al. A qualitative exploration of barriers and motivators to physical activity participation in women treated for breast cancer. Disabil Rehabil 2013;35(24):2038–45. https://doi.org/10.3109/09638288.2013.802378.
[10] Oyekanmi G, Paxton RJ. Barriers to physical activity among African American breast cancer survivors. Psycho Oncol 2014 Nov;23(11):1314–7. https://doi.org/10.1002/pon.3527.
[11] Binkley JM, Harris SR, Levangie PK, et al. Patient perspectives on breast cancer treatment side effects and the prospective surveillance model for physical rehabilitation for women with breast cancer. Cancer 2012;18:2207–16. https://doi.org/10.1002/cncr.27469.
[12] Irwin ML, McTiernan A, Bernstein L, et al. Physical activity levels among breast cancer survivors. MedSportExer 2004;36(9):1484–91.
[13] Harrison S, Hayes SC, Newman B. Level of physical activity and characteristics associated with change following breast cancer diagnosis and treatment. Psycho Oncol 2009 Apr;18(4):387–94. https://doi.org/10.1002/pon.1504.
[14] Lohmann AE, Ennis M, Taylor SK, et al. Metabolic factors, anthropometric measures, diet, and physical activity in long-term breast cancer survivors: change from diagnosis and comparison to non-breast cancer controls. Breast Canc Res Treat 2017 Jul;164(2):451–60. Epub 2017 Apr 25, https://doi.org/10.1007/s10549-017-4263-z.
[15] Hong S, Bardwell WA, Natarajan L, et al. Correlates of physical activity level in breast cancer survivors participating in the Women's Healthy Eating and Living (WHEL) Study. Breast Canc Res Treat 2007 Jan;101(2):225–32. Epub 2006 Sep. 21, https://doi.org/10.1007/s10549-006-9284-y.
[16] Bertram LA, Stefanick ML, Saquib N, et al. Physical activity, additional breast cancer events, and mortality among early-stage breast cancer survivors: findings from the WHEL Study. Cancer Causes Control 2011 Mar;22(3):427–35. Epub 2010 Dec 24, https://doi.org/10.1007/s10552-010-9714-3.
[17] Keegan TH, Shariff-Marco S, Sangaramoorthy M, et al. Neighborhood influences on recreational physical activity and survival after breast cancer. Cancer Causes Control 2014 Oct;25(10):1295–308. Epub 2014 Aug 5, https://doi.org/10.1007/s10552-014-0431-1.
[18] Boyle T, Vallance JK, Ransom EK, et al. How sedentary and physically active are breast cancer survivors, and which population subgroups have higher or lower levels of these behaviors? Support Care Canc 2016 May;24(5):2181–90. Epub 2015 Nov 12, https://doi.org/10.1007/s00520-015-3011-3.
[19] Gadeyne S, Menvielle G, Kulhanova I, et al. The turn of the gradient? Educational differences in breast cancer mortality in 18 European populations during the 2000s. Int J Cancer 2017 Jul1;141(1):33–44. dEpub 2017 Apr 21, https://doi.org/10.1002/ijc.30685.
[20] Trewin CB, Strand BH, Weedon-Fekjær H, et al. Changing patterns of breast cancer incidence and mortality by education level over four decades in Norway, 1971-2009. Eur J Public Health 2017 Feb1;27(1):160–6. https://doi.org/10.1093/eurpub/ckw148.
[21] Andersen BL, Cacioppo JT. Delay in seeking a cancer diagnosis: delay stages and psychophysiological comparison processes. Br J Soc Psychol 1995 Mar;34(Pt 1):33–52. https://doi.org/10.1111/j.2044-8309.1995.tb01047.x.
[22] Yu XQ. Socioeconomic disparities in breast cancer survival: relation to stage at diagnosis, treatment and race. BMC Canc 2009 Oct;14(9):364. https://doi.org/10.1186/1471-2407-9-364.
[23] Yen TW, Czypinski LK, Sparapani RA, et al. Socioeconomic factors associated with adjuvant hormonal therapy use in older breast cancer survivors. Cancer 2011;117(2):398–405. PMC, https://doi.org/10.1002/cncr.25412.
[24] Lundqvist A, Andersson E, Ahlberg I, et al. Socioeconomic inequalities in breast cancer incidence and mortality in Europe-a systematic review and meta-analysis. Eur J Public Health 2016 Oct;26(5):804–13. Epub 2016 May 23, https://doi.org/10.1093/eurpub/ckw070.
[25] Caspersen CJ, Powell KE, Christensen GM. Physical activity, exercise and physical fitness: definitions and distinctions for health-related research. Publ Health Rep 1985 Mar-Apr;100(2):126–31.
[26] Warren JM, Ekelund U, Het al Besson. Assessment of physical activity - a review of methodologies with reference to epidemiological research: a report of the exercise physiology section of the European Association of Cardiovascular Prevention and Rehabilitation. Eur J Cardiovasc Prev Rehabil 2010;17(2):127–39. https://doi.org/10.1097/2FHJR.0b013e32832ed875.
[27] Sallis JF, Saelens BE. Assessment of physical activity by self-report: status, limitations, and future directions. Res Q Exerc Sport 2000;71(sup2):1–14. https://doi.org/10.1080/02701367.2000.11082780.
[28] Sternfeld B, Lee I. Physical activity and cancer. The evidence, the issues, and the challenges. In: Pettee KK, Storti KL, Ainsworth BE, et al., editors. Measurement of physical activity and inactivity in epidemiologic studies. Epidemiological methods in physical activity studies. New York (NY): Oxford University Press; 2009. p. 15–33.
[29] Stalsberg R, Pedersen AV. Are differences in physical activity across socioeconomic groups associated with choice of physical activity variables to report? Int J Environ Res Public Health 2018 May 5;15(5):922. https://doi.org/10.3390/ijerph15050922.
[30] Gidlow C, Halley L, Crone D, et al. A systematic review of the relationship between socio-economic position and physical activity. Health Educ J 2016;65(4):338–67. https://doi.org/10.1177/2F0017896906069378.
[31] Beenackers MA, Kamphuis CBM, Giskes K, et al. Socioeconomic inequalities in occupational, leisure-time, and transport related physical activity among European adults: a systematic review. Int J Behav Nutr Phys Act 2012;9:116. https://doi.org/10.1186/1479-5868-9-116.
[32] Owusu C, Antognoli E, Nock N, et al. Perspective of older African-American and Non-Hispanic white breast cancer survivors from diverse socioeconomic backgrounds toward physical activity: a qualitative study. J Geriatr Oncol 2018;9(3):235–42. https://doi.org/10.1016/j.jgo.2017.12.003.
[33] Strazdins L, Griffin AL, Broom DH, et al. Time scarcity: another health inequality? Environ Plan A 2011;43(3):545–59. https://doi.org/10.1068/2Fa4360.
[34] Engel G. The need for a new medical model: a challenge for biomedicine. Science 1977;196:129–36. https://doi.org/10.1126/science.847460.
[35] Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process 1991;50(2):179–211. https://doi.org/10.1016/0749-5978(91)90020-T.
[36] Kraft P, Sutton SR, Reynolds HMJP, et al. The transtheoretical model of behaviour change: are the stages qualitatively different?. https://doi.org/10.1080/08870449908407339; 1999. 14(3):433-450.
[37] Reidunsdatter RJ, Rannestad T, Frengen J, et al. Early effects of contemporary breast radiation on health-related quality of life - predictors of radiotherapy-related fatigue. Acta Oncol 2011 Nov;50(8):1175–82. Epub 2011 Aug 28, https://doi.org/10.3109/0284186X.2011.604345.
[38] Vardagen 2011 data program [Internet]. Linköping (SE), University of Linköping. Available from: https://liu.se/artikel/vardagen-2011.
[39] VISUAL-TimePAcTS [Internet]. Linköping (SE), University of Linköping. Available from: http://visual-timepacts.itn.liu.se/.
[40] Tashakkori A, Teddlie C. Sage handbook of mixed methods in social & behavioral research. second ed. Thousand Oaks, California: SAGE Publications, Inc.; 2010. https://doi.org/10.4135/9781506335193. [Accessed 20 December 2018].
[41] Hansen BH, Kolle L, Anderssen SA. Fysisk aktivitetsnivå blant voksne og eldre i Norge: oppdaterte analyser basert på nye nasjonale anbefalinger i 2014. Oslo, Norway: Norwegian Directorate of Health; 2014. 05.
[42] Craig CL, Marshall AL, Sjöström M. International physical activity questionnaire (IPAQ): 12-country reliability and validity. J Med Sci Sports Exerc. 2003;vol. 35. https://doi.org/10.1249/01.MSS.0000078924.61453.FB.
[43] Johnson-Kozlow M, Sallis JF, Gilpin EA, Rock CL, Pierce JP. Comparative validation of the IPAQ and the 7-Day PAR among women diagnosed with breast cancer. Int J Behav Nutr Phys Act 2006;3(1):7. https://doi.org/10.1186/1479-5868-3-7.
[44] Conti G, Heckman J, Urzua S. The education-health gradient. Am Econ Rev 100(2):234–238. https://doi.org/10.1257/aer.100.2.234.
[45] Berkman ND, Sheridan SL, Donahue KE, et al. Low health literacy and health outcomes: an updated systematic review. Ann Intern Med 2011;155(2):97–107. https://doi.org/10.7326/0003-4819-155-2-201107190-00005.
[46] Brawley LR, Culos-Reed SN, Angove J, et al. Understanding the barriers to physical activity for cancer patients. Psycho Oncol 2003;20(4):1–21. https://doi.org/10.1300/J077v20n04_01.

[47] Bredland EL, Magnus E, Vik K. Physical activity patterns in older men. Phys Occup Ther Geriatr 2015;33(1):87–102. https://doi.org/10.3109/02703181.2014.995855.
[48] Vallance J, Lavallee C, Culos-Reed N, et al. Rural and small town breast cancer survivors' preferences for physical activity. Int J Behav Med 2013 Dec;20(4):522–8. https://doi.org/10.1007/s12529-012-9264-z.
[49] Murtagh EM, Nichols L, Mohammed MA, et al. The effect of walking on risk factors for cardiovascular disease: an updated systematic review and meta-analysis of randomised control trials. Prev Med 2015;72:34–43. https://doi.org/10.1016/j.ypmed.2014.12.041.
[50] de Rezende LFM, Rey-López JP, Matsudo VKR, et al. Sedentary behavior and health outcomes among older adults: a systematic review. BMC Public Health 2014;14(1):333. https://doi.org/10.1186/1471-2458-14-333.
[51] Ball K, Salmon J, Giles-Corti B, et al. How can socio-economic differences in physical activity among women Be explained? A qualitative study. Women Health 2006;43(1):93–113. https://doi.org/10.1300/J013v43n01_06.
[52] Mackenbach JP. Persistence of social inequalities in modern welfare states: explanation of a paradox. Scand J Publ Health 2017;45(2):113–20. https://doi.org/10.1177/2F1403494816683878.
[53] Langhammer A, Krokstad S, Romundstad P, et al. The HUNT study: participation is associated with survival and depends on socioeconomic status, diseases and symptoms. BMC Med Res Methodol 2012;12(1):143. https://doi.org/10.1186/1471-2288-12-143.
[54] Sharrocks K, Spicer J, Camidge DR, et al. The impact of socioeconomic status on access to cancer clinical trials. Brit J Cancer 2014;111(9):1684. https://doi.org/10.1038/bjc.2014.108.
[55] WMA declaration of Helsinki [Internet]. The World Medical Association, Inc. Available from: https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/.
[56] Östergren O, Lundberg O, Artnik B, et al. Educational expansion and inequalities in mortality—a fixed-effects analysis using longitudinal data from 18 European populations. PLoS One 2017;12(8):e0182526. https://doi.org/10.1371/journal.pone.0182526.